

## Method and System for Down-Converting an Electromagnetic Signal, and Transforms for Same

### *Abstract*

Methods, systems, and apparatuses, and combinations and sub-combinations thereof, for down-converting an electromagnetic (EM) signal are described herein. Briefly stated, in embodiments the invention operates by receiving an EM signal and recursively operating on approximate half cycles ( $\frac{1}{2}$ ,  $1\frac{1}{2}$ ,  $2\frac{1}{2}$ , etc.) of the carrier signal. The recursive operations can be performed at a sub-harmonic rate of the carrier signal. The invention accumulates the results of the recursive operations and uses the accumulated results to form a down-converted signal. In an embodiment, the EM signal is down-converted to an intermediate frequency (IF) signal. In another embodiment, the EM signal is down-converted to a baseband information signal. In another embodiment, the EM signal is a frequency modulated (FM) signal, which is down-converted to a non-FM signal, such as a phase modulated (PM) signal or an amplitude modulated (AM) signal.

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